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Some considerations on the intrinsical hazard associated to the lava dome emplacement and destruction cyclic process at Popocatépetl volcano, Mexico.

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Popocatépetl is surrounded by one of the world's most densely populated areas. Its eruptive history records a wide range of eruption types, from low-intensity effusive episodes to Plinian phases and even massive debris avalanches. In the last 1200yr, the activity has been moderate, and the 500yr historical record describes several episodes similar to the current one beginning in 1994. This sustained activity includes the cyclic emplacement and destruction of 38 lava domes between 1996 and 2015. The previous historical episode (1919-1927) probably emplaced 10 domes at about half the current rates. Such eruptive history leads to question the significance of the ongoing activity in the context of a volcano capable to produce extreme eruptions. The statistical analysis of the present activity offers some insight into the underlying physical process sustaining the eruption, and the conditions that may signal an evolution into higher-intensity phases. Although the process is irregular and non-stationary in the time domain, in the dimensional domain the maximum volumes and thicknesses of the domes are well described by the exponential survival distribution Nc=No*exp(-V/Va), where No is the number of emplaced domes, Va their average volume, and Nc the number of domes with volumes equal or exceeding V. This may be interpreted in terms of a changing buoyancy force caused by the variable density contrast between volatile-rich magma and country rock. The cyclic character of magma ascent may be a consequence of a self-regulating process caused by intense outgassing of magma controlling buoyancy. The cumulative exponential distribution is the scaling law describing the gravitational energy release of the buoyancy force governing the height and volume of the domes. A significant departure from that scaling law in future dome emplacements may signal a failure of the self-regulating nature of the process that could lead to a different type of eruption.